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SPECIALIZED HANDLING EQUIPMENT. VOLUME I

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BOEING

TECHNICAL MANUAL
SPECIALIZED HANDLING EQUIPMENT

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ABSTRACT

This two volume manual provides technical information relating to the installation, operation and general maintenance of the Specialized Handling Equipment. This equipment was designed to tow and handle a faired towline and depressor combination during high speed towing operations in calm seas and at variable depths using the PCH-1 HIGH POINT hydrofoil ship as the towing vehicle. Volume 1 contains the general technical infomation. Volume 2 contains the index and all drawings describing the Specialized Handling Equipment.

KEY WORDS

SPECIALIZED HANDLING EQUIPMENT
TOWLINE
DEPRESSOR
NAVAL UNDERSEA RESEARCH AND DEVELOPMENT CENTER
WINCH
HIGH POINT
PCH-1
HYDROFOIL

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1.0 GENERAL INFORMATION

1.1 SCOPE

This two volume manual provides the technical information necessary for installation, operation, trouble shooting and maintenance of the Specialized Handling Equipment, Figure 1, designed for the Naval Undersea Research and Development Center, San Diego, California, under Contract N00123-68-C-0543. Volume 1 contains the general technical information necessary to utilize the Specialized Handling Equipment properly.

Volume 2 contains all drawings describing the Specialized Handling Equipment and its shipboard installation.

1.2 BACKGROUND

The title, Specialized Handling Equipment (S.H.E.), is a phrase used to identify a specially designed, unique system of essentially conventional equipment factored into a single hardware package weighing approximately 6726 pounds. The S.H.E. will be cantilevered aft from the transom of the U.S. Navy hydrofoil ship PCH-1 HIGH POINT. From that position the S.H.E. together with two other items, namely a faired towline and an actively controlled depressor, will be used to conduct high speed towing operations in relatively calm seas. A brief description of both the towline and the depressor is included in the following paragraphs before describing the S.H.E. to provide a basis for understanding the intended functions and capabilities of the S.H.E.

The towline to be used in conjunction with the S.H.E. is a high speed, continuously faired towline produced under Contract N00123-68-C-0290 for the Naval Undersea Research and Development Center. The towline winds about the S.H.E.'s winch drum and lands in the specially contoured grooves provided on the winch drum surface. The 600 foot towline can be payed out to any desired length for high speed towing operations to permit various depressor depths below the sea surface to be accomplished. The towline achieves low drag by virtue of its small size attained by a faired cross section which uses high strength fiberglass for the tension carrying

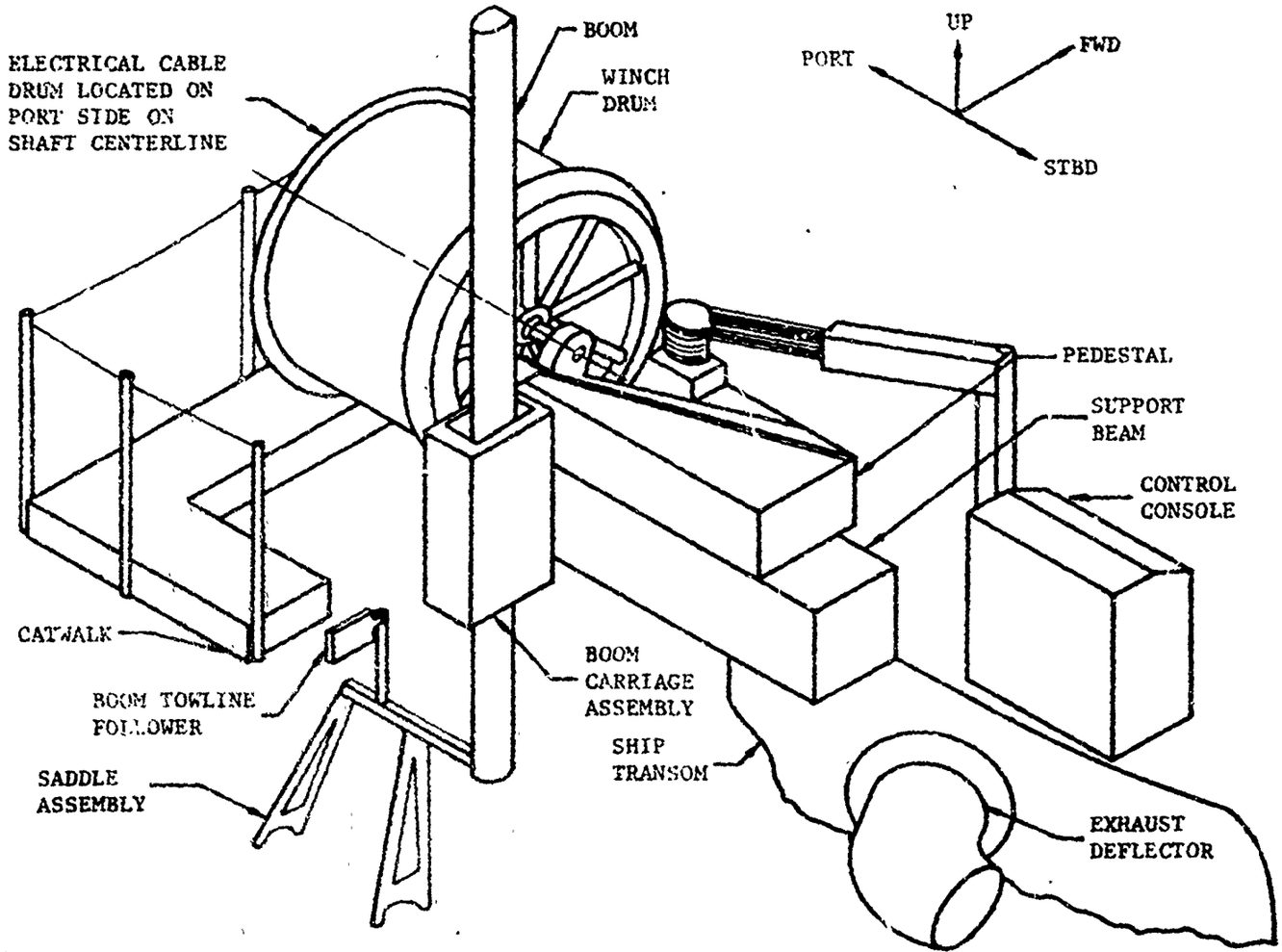

FIGURE 1: SPECIALIZED HANDLING EQUIPMENT

strength number. The towline's trailing edge is a continuous smooth rubber fairing which contains two coaxial electrical cables for electrical power and signal transmissions.

The depressor to be used with the S.H.E. was specially developed by the Naval Undersea Research and Development Center. The depressor employs an active control system which allows shipboard personnel to "fly" it behind the ship in a wide variety of positions relative to the ship. The depressor generates large downloads dynamically by means of a hydrofoil (wing-like) surface to enable the depressor to be positioned steeply behind the ship at high speeds. This steep angle towing capability at high speeds is in sharp contrast to the relatively shallow angles of towing experienced with existing depressors that utilize only weight for download force and a variety of faired and unfaired cables for the umbilical between ship and depressor.

1.3 DESCRIPTION OF SPECIALIZED HANDLING EQUIPMENT

A description of the functions and major hardware components making up the S.H.E. is contained in the following paragraphs. Attention is invited to the fact that all drawings pertinent to the S.H.E. and its installation on board ship are contained in Volume 2 of this manual. Potential S.H.E. operators should become familiar with the content of Volume 2 before attempting to operate the S.H.E. Knowledge of the basis for design as identified in the final report (reference 1) to Contract N00024-68-C-0543 will be useful, but is not mandatory to enable operators to safely and effectively use the S.H.E. for its intended purpose.

Broadly speaking the basic design features that have been incorporated into the S.H.E. are as follows:

(1) To account for the variance anticipated between the changing ship's direction and the towing equipments trailing deep in the sea, the S.H.E. has been designed to swivel automatically over a very wide angle, from port to starboard, while experiencing a wide range in towline tension and vector directions. Automatic swiveling is achieved regardless of the ship's forward speed in either the hullborne or foilborne mode.

(2) The S.H.E. has been designed to provide for the launching and retrieval of the depressor while underway in the hullborne mode at speeds up to five knots. Control of the depressor as it passes through the air-water interface is maintained by a boom which holds it firmly during this operation to prevent damage. The boom can be positioned to provide for depressor drag-induced motions as well as rolling of the ship. Furthermore, the boom has a large vertical travel which enables (1) the depressor to be "released" or "picked-up" while it is below the ship's keel depth and (2) the hoisting of the depressor to an elevation above the main deck to allow for 170 degree swiveling of the S.H.E. over the deck to bring the depressor on board the ship for storage and/or servicing purposes.

(3) Prior to towing operations, a desired length of towline is payed off the winch drum and the drum is locked in position to prevent unwinding due to the large towline tensions anticipated when foilborne. The S.H.E. has the capability to haul in or pay out the towline-depressor equipment only during slow speed hullborne operations.

With these features in mind, the major portions of the S.H.E. will now be described.

Figure 1 is an isometric sketch of the Specialized Handling Equipment. Orientation of the craft in Figure 1 may be visualized by noting the partial view of the transom of the ship in the lower right hand portion of the sketch, and by noting the vectors presented at the upper right hand edge of the figure.

In Figure 1 it will be noted that there appears to be two relatively dissimilar pieces of equipment joined by a set of umbilicals. The control console provides the levers, switches, etc., that cause the S.H.E. to function. The S.H.E. proper is cantilevered over the stern in what is defined as the "winch dead astern" position.

Careful examination of Figure 1 will reveal that though the S.H.E. appears at first to be complex, it has several subassemblies which are relatively simple to understand. For example, on the left there is a catwalk. This provides access to the aft side of the S.H.E. as shown. The winch drum holds the towline (not shown in the sketch) in contoured grooves cut into its circumferential face. The boom is a long, partially streamlined member that is shown vertically in the figure. There is also both a boom towline follower and a saddle assembly located at the lower portion of the boom. These items, as well as the boom carriage assembly which supports the boom, are features of the handling system that give rise to the name Specialized Handling Equipment. The functions of these items will be discussed in a subsequent paragraph. The S.H.E. pedestal supports the winch drum. A support beam, which is welded by structural attachments to the ship itself, supports a kingpost upon which the pedestal swivels. The umbilicals referred to earlier are the electrical cables and hydraulic lines that join the S.H.E. proper to its control console. It should be noted that the faired towline has been omitted from the sketch as has the depressor in order to emphasize the S.H.E. and not its two ancillary equipments.

Attention is drawn to those items that are quite different from a "normal" winch. These are specifically (1) the boom, (2) the boom carriage assembly, (3) the saddle assembly and (4) the towline follower.

The boom is notable in that it has a rack-gear along its after edge which allows the boom to be raised upward or lowered downward while passing through the boom carriage assembly. A small hydraulic motor located on the boom carriage assembly provides the motive power. The boom carriage assembly itself has two special capabilities. The first is that it has the ability to be rotated about a fore and aft directed axis (with the position depicted in the sketch) allowing the boom to remain in an essentially vertical position even though the ship, while hullborne, is responding to waves by rolling from side to side. This freedom prevents the ship, through an otherwise rigid structure, from forcing the boom to follow the rolling motion of the ship, causing the boom to transmit excessive motion to the depressor.

The boom carriage assembly also has a second capability which is that it can also be rotated about an athwartships axis (in the position depicted in the sketch). This feature allows the S.H.E. operator to determine at will the fore and aft position of the lower portion of the boom. (The lower boom carries the saddle assembly which in turn holds the depressor). This is essential since the operator, when retrieving the depressor from depth, will want to position the saddle assembly mounted on the lower portion of the boom directly over the depressor irrespective of the local drag forces on the lower boom that would otherwise cause the towline follower to be swept aft into the towline. This same detrimental effect can also occur at the moment of launch of the towed body when the depressor is released from the saddle since the same relatively high drag of the lower boom and saddle assembly would push hard in an aft direction against the towline, possibly causing it injury. The boom carriage assembly achieves these controlled pitching and rolling motions by means of separate hydraulic cylinders controlled by the S.H.E. operator.

The boom towline follower fulfills its function by acting as a means of locating the downward protruding extensions of the saddle assembly so that the bottom surfaces of these extensions will always contact the upper hydrofoil (wing-like) surfaces protruding laterally from the depressor at precisely the required locations. The S.H.E. operator uses the boom towline follower only when retrieving the depressor from depth. During this retrieval procedure he "flies" the lower boom by causing the boom carriage assembly to pitch and roll in response to his visual observations of the lower boom portion as he causes the lower boom portion to move carefully downward to meet the depressor when the depressor is just beneath the water's surface. With the aid of the boom towline follower the S.H.E. operator can position the lower boom and its saddle assembly into the correct position for mating with the depressor if he keeps the boom towline follower always engaged with the towline, but never forcing it to exert a large load against the towline. This explains the use of the wording "the S.H.E. operator flies" the lower boom and saddle assembly earlier in this paragraph. The boom towline follower is lined with specially contoured Teflon which prevents damage to the rubber cover of the towline. It should be noted that the

boom towline follower is not utilized during the depressor launching sequence since up to the moment of launch, the depressor and the saddle assembly are being firmly held together by opposing forces as will be explained later in this manual. At the exact moment of launch the S.H.E. operator raises the lower boom portion with its saddle assembly and moves it forward. Thus there is no need for the boom towline follower during the launch procedure.

The remainder of this manual is devoted to the step-by-step sequence of operations required to operate the S.H.E. Attention is called out where necessary to certain conditions under which special caution should be exercised. Numerous safety features have been provided in the design of the S.H.E. to minimize the chance for injury to personnel and the equipment. It is urged that S.H.E. operators assure themselves that any and all test plans adequately consider safety as delineated in this manual.

2.0 INSTALLATION

The following sections identify those drawings in Volume 2 which describe how the installation of the major components and systems comprising the S.H.E. is to be accomplished. A brief commentary is provided to identify the particular installation method. Reassembly of any components disassembled for ease in shipping the large S.H.E. may be accomplished by referring to the appropriate drawings, all of which are contained in Volume 2 of this document.

2.1 PRIMARY STRUCTURAL INSTALLATION

The primary structural attachment of the S.H.E. to the PCH-1 is accomplished by the welding of the S.H.E. support beam assembly brackets to the stern of the ship. This installation is shown in drawing 25-56051.

2.2 SECONDARY STRUCTURAL INSTALLATIONS

Installation of the control console, hydraulic hose support and towed body deck cradle is shown in drawing 25-56051. Installation of these components is accomplished by either welding or bolting them to the ship as indicated in the drawings.

2.3 EXHAUST DEFLECTOR INSTALLATION

The two exhaust deflectors are installed on the ship by inserting them into the open ends of the existing exhaust ducts and securing them with turnbuckle assemblies. Adjustments are accomplished by means of the turnbuckles. This installation is shown in drawing 25-56071.

2.4 HYDRAULIC SYSTEM INSTALLATION

Installation of the hydraulic system is accomplished by (1) plumbing into existing ship's service hydraulic pressure and return lines and (2) completing plumbing between the control console and the winch proper. This installation is shown in drawing 25-56051. A schematic of the system is shown on 25-56065.

Note: Because of degradation of the Hypalon-covered towline if contacted by Skydrol hydraulic fluid (discussed in section 5.6.2), it is of utmost importance that all possible precautions be taken to insure that the hydraulic system is completely leak-free before installation of the towline on the S.H.E. drum. All plumbing should be hydrostatically tested after installation in accordance with notes on the installation drawing, and any leaks corrected.

Since Skydrol may be irritating to human skin and is severely irritating to eye and lung tissue, precautions are warranted during hydrostatic testing and at any time when hydraulic leaks are considered possible.

2.5 ELECTRICAL SYSTEM INSTALLATION

Installation of the electrical system is accomplished by (1) tapping into the existing ship's electrical service wiring and (2) completing wiring required to join the control console and the winch proper. This installation is shown in drawing 25-56067.

2.6 ELECTRICAL CABLE DRUM INSTALLATION

Installation of the electrical cable drum is accomplished by bolting it to the end of the main winch drum shaft on the port side of the S.H.E. This installation is shown in drawing 25-56066.

2.7 SPECIAL MARKINGS

The painted triangular markings shown on the boom on Figure 2 are to be applied by the S.H.E. operator. They may be located so as to position the boom three to six inches above its full-down position, or at another location selected to achieve best compatibility between the S.H.E. and the ship.

Markings may be applied to the towline to indicate payed out length. These could take the form of color bands, applied at intervals and coded to indicate length in the manner that electrical resistors are color coded to indicate resistance values.

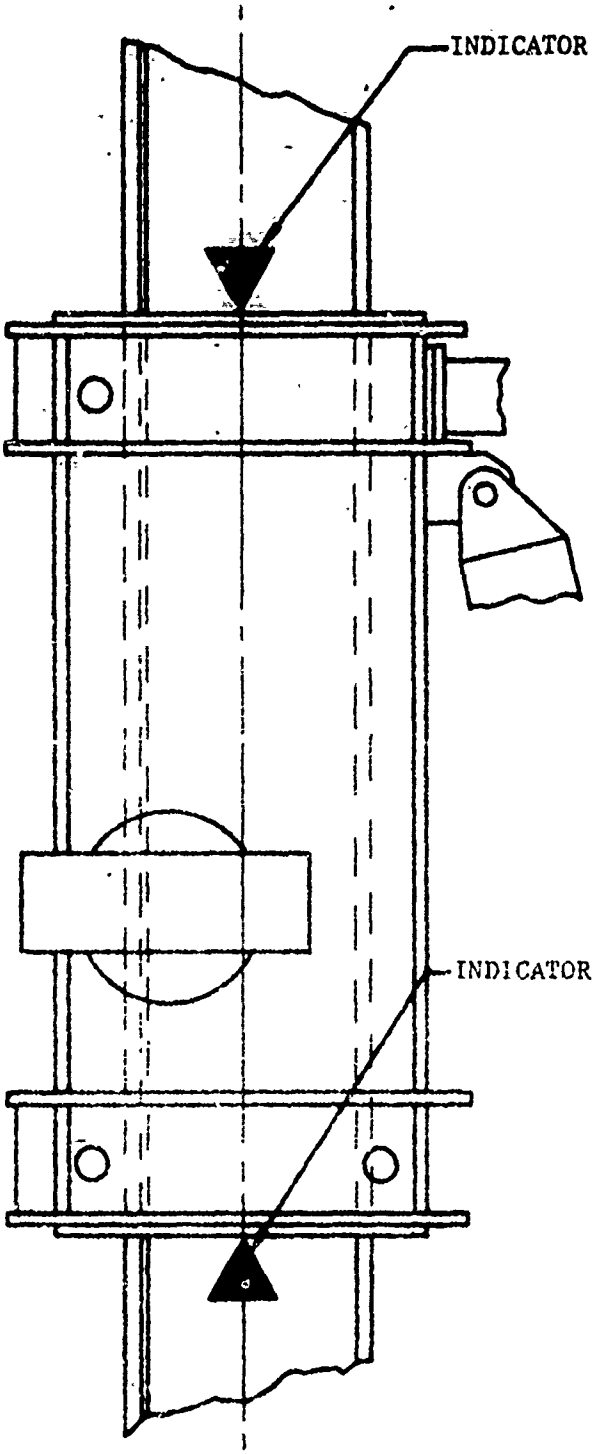

FIGURE 2: BOOM PRELAUNCH POSITION

Similarly, a prominent mark should be placed on the towline which will indicate that the depressor is at retrieval depth. This depth corresponds to the launch depth indicated by the triangular marks on the boom, and should be placed on the towline so that it is at the water surface when the depressor is at retrieval depth.

3.0 OPERATION PROCEDURES

3.1 INTRODUCTION

The procedures presented herein are definitive guides to the operation of the Specialized Handling Equipment. As such, these procedures should be followed as closely as possible and all cautionary notes strictly observed.

Persons who will operate or are responsible for the operation of the Specialized Handling Equipment should become familiar with the contents of this manual. Before proceeding further, potential operators of the equipment should become acquainted with the S.H.E. by examining the construction drawings presented in Volume 2 of this document. It is to be noted that all of the detail parts of the S.H.E. as well as their assembly and installation into an integrated whole is depicted in the drawings contained in Volume 2. Information concerning the design criteria may be found in reference 1 where the criteria are presented in detail.

3.2 NOMENCLATURE

The nomenclature that describes the operation of the S.H.E. can be considered to consist of three major categories. First, there are the several definitions of positions of the S.H.E. and the depressor that will be repeatedly used. Secondly, there is a specific code used in this manual to identify the terminology applied to the various switches, controls, control and switch positions and parts of the S.H.E. Section 3.2.1 provides the position definitions of the S.H.E. Section 3.2.2 provides the terminology code used in this manual. Since understanding of the control console labels is vital to the proper operation of the S.H.E., a third category describing such items is included in Section 3.2.3.

3.2.1 Definitions of Position

3.2.1.1 Winch Astern

The phrase "winch astern" is used to define the position of the winch (and depressor handling equipment) when it is located aft of the towing vehicle's transom in towing position.

3.2.1.2 Winch Dead Astern

The phrase "winch dead astern" is used to define the position of the winch when it is furthest aft of the ship's transom. In this position, the winch drum axis of rotation is perpendicular to the centerline of the towing vehicle.

3.2.1.3 Winch Ahead

The phrase "winch ahead" is used to define the position of the winch when it is in the most forward position ahead of the transom and over the ship's deck. This winch position lies a few degrees to port of the tow vehicle's centerline to provide for depressor storage and maintenance on deck.

3.2.1.4 Depressor Secured

The phrase "depressor secured" is used to define the position of the depressor when it is supported at maximum height in the S.H.E. and prevented from moving relative to the winch drum. All mechanical and electrical connections between the winch and the depressor are complete, and the depressor is ready for towing operations.

3.2.1.5 Depressor Stowed

The phrase "depressor stowed" is used to define the position of the depressor when it is physically detached from the S.H.E., both mechanically and electrically and lying in its deck mounted storage cradle. The S.H.E. swivel position is specifically not related in any way to the "depressor stowed" condition.

3.2.2 Terminology Code

Throughout this document, reference will be made to various switches, controls, control and switch positions and parts of the S.H.E. The following code will be used to differentiate the terminology applied to these items.

3.2.2.1 Switches, Gages, Indicator Lights and Controls

Upper case and underlined. Example: CONTROL MODE.

3.2.2.2 Switch and Control Positions

Upper case and in quotation marks. Example: "AUTO."

3.2.2.3 S.H.E. Components

Upper case. Example: SAFETY LINK.

3.2.2.4 Equipment and Component Positions

Lower case and in quotation marks. Example: "depressor stowed" position.

3.2.3 Control Console Terminology

The following paragraphs explain the terminology found on the label places on the CONTROL CONSOLE. Figure 3 depicts the CONTROL CONSOLE panel.

3.2.3.1 CONTROL MODE Switch

A rotary switch, console mounted, which selects the type of control (automatic or manual) to be used to cause the winch to swivel about its vertical axis.

3.2.3.2 DRUM BRAKE Switch

A two-position toggle switch which selects either a "NORM" (normal) braking mode in which the brake is engaged except when the winching motor is being operated, or a "TOWING" mode in which the brake is disengaged.

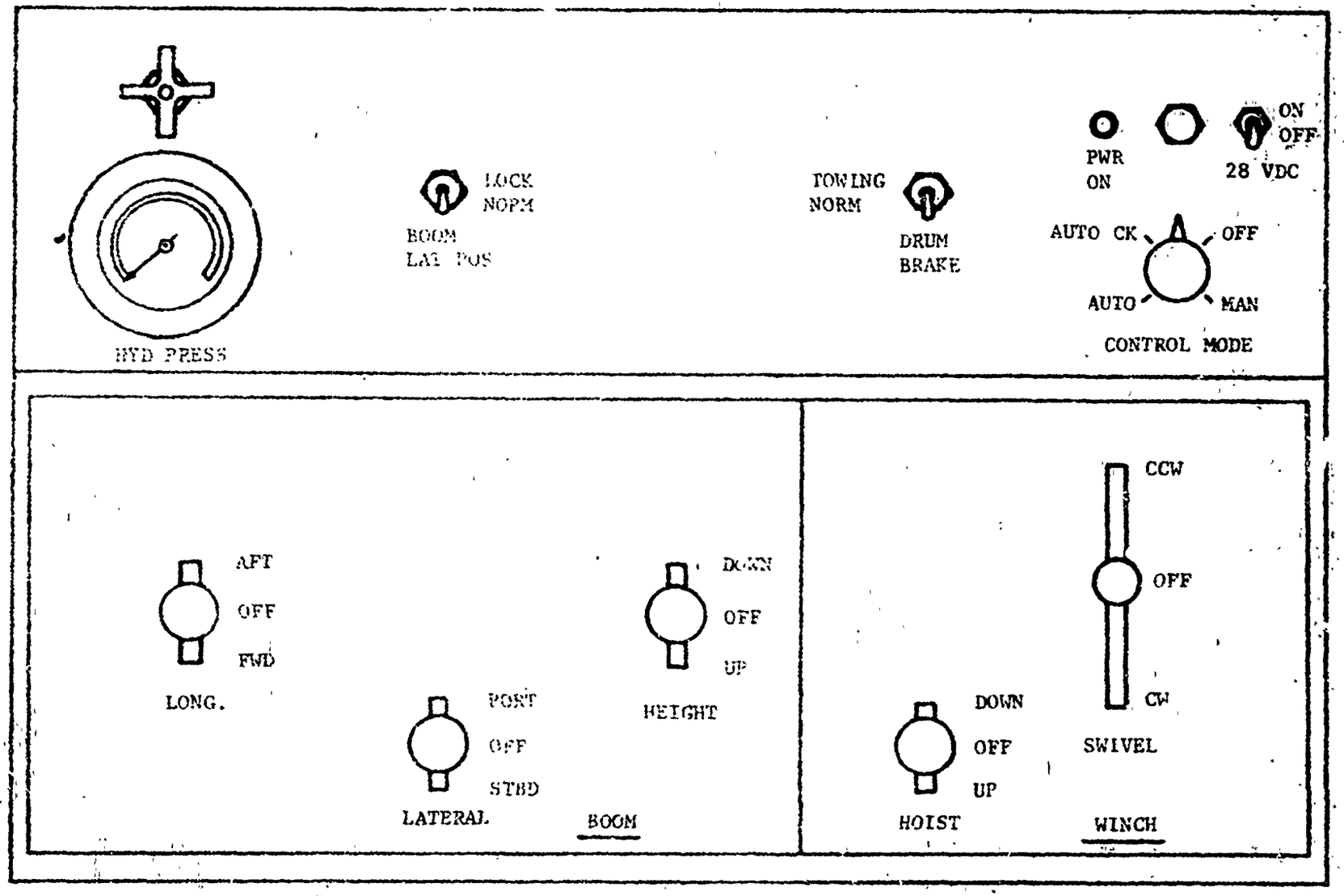

FIGURE 3: CONTROL CONSOLE PANEL

3.2.3.3 BOOM LAT POS Switch

A two-position toggle switch which eliminates lateral motion of the boom when the switch is placed in the "LOCK" position or which permits lateral movement to be controlled by the BOOM LATERAL control lever in the switch is in the "NORM" position.

3.2.3.4 WINCH SWIVEL Control

A variable-rate control which permits the operator to manually swivel the winch during depressor launch, retrieval, and stowage operations. This control is functional only when the CONTROL MODE switch is in "MAN" (manual) position. Moving the control knob further from the "OFF" (center) position increases the swiveling rate.

3.2.3.5 WINCH HOIST Control

A variable-rate spring-centered control which permits the operator to rotate the winch drum so as to raise or lower the depressor. When the control is moved to "UP", the drum reels in the towline; when the control is moved to "DOWN", the drum pays out the towline.

3.2.3.6 BOOM HEIGHT Control

A variable-rate, three-detent control which enables the operator to raise or lower the boom.

3.2.3.7 BOOM LATERAL Control

A variable-rate, spring-centered control which permits the operator to vary the lateral position of the boom.

3.2.3.8 BOOM LONG. Control

A variable-rate, spring-centered control which permits the operator to vary the longitudinal (fore and aft) position of the boom.

3.2.3.9 HYD SUP (Hydraulic Supply) Control

A two-position shut-off valve in the hydraulic supply line. The two positions are "OPEN" and "CLOSED".

3.2.3.10 HYD PRESS Gage

A gage which monitors hydraulic supply pressure.

3.2.3.11 PWR ON Light

A green indicator light which lights when the 28 volt DC power is energized.

3.2.3.12 28 VDC Switch

A two-position toggle switch in the 28 volt DC power supply line which energizes the S.H.E. electrical system.

3.2.3.13 BOOM-UP-LOCK Control

A tee-handled control for the push-pull cable actuating the mechanical boom-up-lock. This control is spring loaded toward the "lock" position, but will remain in the "unlock" position if the tee handle is twisted to the right (clockwise) after it has been pulled.

3.2.3.14 BOOM-LATERAL-LOCK Control

A tee-handled control for the push-pull cable actuating the mechanical boom-lateral-lock. This control is spring-loaded toward the "lock" position, but will remain in the "unlock" position if the tee handle is twisted to the right (clockwise) after it has been pulled.

3.3 LAUNCH PREPARATION PROCEDURE

The following procedure is required to take the system from a fully secured, de-energized condition of the S.H.E. with the depressor in the "depressor stowed" position to a pre-launch condition in which the depressor is secured to the restraint gear and ready for deployment in the sea.

3.3.1 Starting Conditions

The winch is in the "winch dead astern" position with the SWIVEL LOCK PIN installed; the depressor is in the "depressor stowed" position in its deck cradle; S.H.E. hydraulic and electrical power are off; the BOOM-UP-LOCK and BOOM LATERAL LOCK are engaged.

3.3.2 Launch Preparation

3.3.2.1

Energize ship's service hydraulic system by following normal procedures for starting the ship's service diesel as prescribed in the ship's technical manuals.

3.3.2.2

At the CONTROL CONSOLE place CONTROL MODE switch on "MANUAL". Place BRAKE switch on "NORMAL". Verify that all control levers or knobs on the CONTROL CONSOLE are in the "OFF" position.

3.3.2.3

Energize winch hydraulic system by operating HYD SUP valve on console. Verify that system pressure is between 2850 psi and 3100 psi by reading HYD PRESS gage.

3.3.2.4

Energize winch electrical system by moving 28 VDC switch to "ON" position. Illumination of green PWR ON light will indicate that power is on.

3.3.2.5 Remove the SWIVEL LOCK PIN

The hydraulically-locked swiveling actuator will maintain the winch drum lateral position in the "winch dead astern" position. If it is necessary to swivel the winch slightly to remove the swivel locking pin, see 3.3.2.6.

> **CAUTION:** In the following step, the winch must not be swiveled past a position just forward of the transom. No attempt must be made to place the winch and restraint gear over the depressor until a portion of the saddle assembly is disengaged to eliminate physical interference between saddle and depressor.

3.3.2.6

To swivel winch over deck, place CONTROL MODE switch in "MANUAL", then move winch clockwise by pulling WINCH SWIVEL control lever toward "CW". Rate of swiveling is proportional to the distance the lever is moved from its neutral position.

3.3.2.7

Disengage removable portion of saddle assembly. Re-initiate swiveling of the winch drum and restraint gear until the BOOM is positioned above the depressor by moving WINCH SWIVEL control lever toward "CW" (CONTROL MODE switch still on "MANUAL").

3.3.2.8

Reinstall removable portion of SADDLE ASSEMBLY. (Equipment removed in step 3.3.2.7 above.) Remove TOWLINE RESTRAINT BARS if these are in place.

3.3.2.9

Connect towline to depressor per instructions to be found in the depressor technical manual, reference 2.

> NOTE: It is necessary to maintain some tension at all times on the free end of the towline to prevent it from expanding away from the drum surface. Should towline tension be relaxed, one or two turns may roll and attempt to lie flat on the drum. If this occurs, the towline can be repositioned by (1) verifying that the nose of each turn of the towline is located within 0.50 inches (half

the width of a groove) from the center of the groove in which it is to nest, and (2) carefully winching in the slack towline by moving the WINCH HOIST control toward "UP" until the towline is again tight on the drum with its nose correctly positioned at the bottom of the drum groove.

3.3.2.10

Engage SADDLE and depressor as follows:

a) Remove all tie-down gear holding depressor to deck cradle.

b) Raise BOOM to maximum height by moving BOOM HEIGHT control to "UP" until BOOM stops. This frees BOOM-UP-LOCK mechanism.

c) Disengage BOOM-UP-LOCK by pulling TEE HANDLE. Twist the handle clockwise to prevent re-engagement.

d) Return BOOM HEIGHT control to "OFF".

NOTE: Immediately after step (d) above is accomplished, BOOM will descend by gravity at the rate of approximately one inch per second. Pull BOOM HEIGHT control lever to "UP" position either to slow down rate of fall or to stop descent of BOOM if SADDLE BAYONET does not appear to be properly engaging the socket located on the upper surface of the depressor. If engagement is not going to be proper, raise BOOM to full up position and manually engage BOOM-UP-LOCK before attempting to make position adjustments of either the BOOM or the depressor to permit engagement. Repeat steps 3.3.2.8 and 3.3.2.10 until SADDLE BAYONET properly engages the depressor socket.

CAUTION: In the following step, failure to have BOOM HEIGHT lever in the "DOWN" position will result in damage to the towline since the depressor will pitch severely due to the fact that its center of gravity is not directly beneath the SADDLE ASSEMBLY.

3.3.2.11

Place depressor in "depressor secured" position as follows:

a) With CONTROL MODE switch still in "MANUAL" and BRAKE switch still in "NORMAL", place BOOM HEIGHT control in "DOWN" position and hold it there until step (c) below is accomplished.

b) Move WINCH HOIST lever to "UP" position. Winch drum will then overcome boom downward force and raise depressor and boom upward.

c) When depressor is raised upward to the "depressor secured" position, move WINCH HOIST lever to "OFF" position to stop machinery and engage SAFETY LINK to insure against winch drum paying out towline inadvertently and lowering depressor with probable attendant damage as identified in caution note above.

3.3.2.12

If towing operations are to begin immediately, proceed with Section 3.4. If towing operations are not to begin immediately, install SWIVEL LOCK PIN to lock winch in "winch ahead" position and turn off electrical and hydraulic power at CONTROL CONSOLE to de-energize S.H.E.

3.4 DEPRESSOR LAUNCH PROCEDURE

The following is the procedure required to launch the depressor and prepare the S.H.E. for high speed towing.

3.4.1 Starting Conditions

The depressor is in the "depressor secured" position with the winch placed in the "winch ahead" position; S.H.E. power is off; the ship is cruising hullborne on diesel propulsion power at a speed of five knots or less; all ship's systems necessary for towing are operating. (Depressor instrumentation and control systems will have been checked out per NURDC procedures which are not a part of this manual.)

3.4.2 Launch Procedure

3.4.2.1

Place winch CONTROL MODE switch on "MANUAL" and BRAKE switch on "NORMAL".

3.4.2.2

Energize the S.H.E. hydraulic system by moving the HYD SUP valve located at the side of the console to "OPEN". Verify that system pressure is between 2850 psi and 3100 psi by checking the HYD PRESS gage.

3.4.2.3

Energize the S.H.E. electrical system by moving the 28 VDC switch to its "ON" position. Illumination of green indicator light will indicate that power is on.

3.4.2.4

Remove SWIVEL LOCK PIN. Apply instructions of 3.3.2.6 to swivel winch.

3.4.2.5

Swivel winch to the "winch dead astern" position by moving the WINCH SWIVEL control lever to "CCW" position. Return WINCH SWIVEL control lever to "OFF" when winch attains the "winch dead astern" position.

3.4.2.6

To launch the depressor, leave CONTROL MODE switch in "MANUAL" and BRAKE switch in "NORMAL". Then proceed as follows.

> CAUTION: In the following step, BOOM HEIGHT control lever must be kept in "DOWN" position until launch; i.e., depressor is in the water and ready to have the SADDLE ASSEMBLY retracted.

3.4.2.6.1

Move BOOM HEIGHT control lever to "DOWN" and leave it there.

2.4.2.6.2

Disconnect SAFETY LINK which prevents winch drum rotation (and towline payout).

> CAUTION: Step 3.4.2.6.3 must be followed without fail.

3.4.2.6.3

Raise depressor to maximum up position by moving WINCH HOIST control to "UP" position. Since depressor is already in the depressor secured position, the observed motion will be slight.

3.4.2.6.4

Disengage manual BOOM-UP-LOCK by pulling TEE HANDLE control located on S.H.E. Twist the TEE HANDLE clockwise so that the BOOM-UP-LOCK remains disengaged.

3.4.2.6.5

Move WINCH HOIST lever toward "DOWN" position and pay out towline until the indicator triangles on the boom are at the edges of the carriage as shown in Figure 2.

At this point, the depressor will be just beneat the surface of the water. Stop motion by returning WINCH HOIST lever to "OFF" position.

> NOTE: At the option of the operator, the winch drum BRAKE may be left engaged when lowering the depressor and BOOM to provide more accurate vertical positioning of the depressor. This is accomplished by moving the 28 VDC switch to "OFF" temporarily during payout only.

3.4.2.6.6

Shut off ship's diesel hullborne power and retract the diesel outdrive unit.

CAUTION: Craft speed in the following step must not exceed eight knots.

3.4.2.6.7

Start one foilborne gas turbine and run it at idle.

3.4.2.6.8

Engage instrumentation system towline follower to the towline. This is to be accomplished by a man standing on catwalk.

3.4.2.6.9

Retract movable portion of catwalk and fasten it securely with line to hold it in its retracted position.

3.4.6.10

Raise BOOM by moving BOOM HEIGHT control to "UP". As soon as an upward motion of the BOOM is noted with respect to the CARRIAGE, simultaneously move the SADDLE forward by moving BOOM LONG control to "FWD" position and the CONTROL MODE switch to "AUTO" position.

A successful launch will be indicated by the SADDLE moving up and forward away from the depressor. Should the SADDLE (and BOOM) fail to rise, the SADDLE has not freed itself from the depressor (the BOOM vertical drive motor is not strong enough to lift the depressor). In this event, the BOOM LONG control may be moved very carefully to "FWD" or "AFT" to disengage the SADDLE from the depressor. Immediately upon disengagement, move the BOOM LONG control to "FWD" and the CONTROL MODE switch to "AUTO". Should longitudinal motion of the boom fail to free the SADDLE from the depressor, the depressor should be retracted from the water and returned to its deck cradle on the ship (see Section 3.5) to determine the reason for failure of the SADDLE to disengage from the depressor.

3.4.2.6.11

Pay out approximately six more feet of towline by moving WINCH HOIST control to the "DOWN" position. (NOTE: Six feet of towline is approximately one-third of a revolution of the winch drum.)

3.4.2.6.12

Engage the manual BOOM-UP-LOCK. Return BOOM HEIGHT to "OFF" position.

3.4.2.7

Start second foilborne gas turbine and run it at idle.

3.4.2.8

Pay out desired towline scope by moving WINCH HOIST control to the "DOWN" position.

NOTE: Scope of towline payed out can be approximated by observing the vacant grooves on drum. Each vacant groove is equivalent to about 19 feet of towline. See also Section 2.7.

3.4.2.9

Install TENSION LINK between the winch drum and pedestal.

NOTE: For reasons of safety, motions of the depressor and ship should be stabilized as much as is practicable with ship heading maintained as constant as possible.

3.4.2.10

Place BRAKE switch in "TOWING" position.

3.4.2.11

Install TOWLINE RESTRAINT BARS if desired.

3.4.2.12

Conduct high speed towing operations per NURDC operational sequence (not a part of this manual).

3.5 DEPRESSOR RETRIEVAL PROCEDURE

The following is the procedure required to retrieve the depressor from a fully deployed position and to secure all equipment.

3.5.1 Starting Conditions

Ship is proceeding hullborne at idle speed on one foilborne gas turbine only; S.H.E. is in "AUTO" control mode with BRAKE switch in "TOWING" position; towing operations have been completed; full or partial scope of TOWLINE is still payed out.

3.5.2 Retrieval Procedure

3.5.2.1

Put BRAKE switch in "NORMAL" position. Remove TOWLINE RESTRAINT BARS if these have been installed.

> CAUTION: In the following step, do not attempt to remove load from the TENSION LINK by rotating the WINCH DRUM with the WINCH HOIST control.

3.5.2.2

Disconnect TENSION LINK between the WINCH DRUM and the S.H.E. pedestal.

> NOTE: For reasons of safety, motions of the depressor and ship should be stabilized as much as is practicable with ship heading maintained as constant as possible.

3.5.2.3

Haul in towline using WINCH HOIST control until depressor is at the depth planned for retrieval. Retrieval depth is indicated when the marking on

towline is at the water surface. Positioning of the towline markings is discussed in Section 2.7.

3.5.2.4

Raise BOOM to full height by moving BOOM HEIGHT control to "UP" position. Disengage manual BOOM-UP-LOCK by pulling TEE HANDLE on S.H.E. pedestal. Lower BOOM approximately one foot. Utilize BOOM HEIGHT control to keep boom in this position.

3.5.2.5

Unlock manual BOOM-LATERAL-LOCK by pulling TEE HANDLE on S.H.E. pedestal. Turn the TEE HANDLE to prevent re-locking.

NOTE: It may be necessary to use BOOM LATERAL control to free the pin.

After pin is free, put BOOM LATERAL POSITION switch in "LOCK" position. Change CONTROL MODE switch to "MANUAL".

3.5.2.6

Disengage the instrumentation system towline follower from the towline and secure it to the catwalk lifeline.

3.5.2.7

Install the BOOM TOWLINE FOLLOWER on the SADDLE ASSEMBLY and towline.

NOTE: Adjust BOOM HEIGHT control to position and hold BOOM in proper attitude to accomplish the BOOM TOWLINE FOLLOWER installation.

3.5.2.8

Put BOOM LATERAL POSITION switch in "NORMAL" position. Extend the BOOM downward along the towline approximately eight feet. Move BOOM LONGITUDINAL

control and WINCH SWIVEL control as required to keep the boom parallel to the towline below the BOOM TOWLINE FOLLOWER, to keep the BOOM TOWLINE FOLLOWER engaged with the towline, and to maintain a low fleeting angle between towline and drum groove. Fleeting angle may be estimated by noting the deviation of the BOOM lateral position from its centered position. Stop the downward motion of the BOOM when the SADDLE ASSEMBLY is just above the water's surface.

> CAUTION: In the following steps, BOOM HEIGHT control must be left in the "DOWN" position until the depressor is retracted to the "depressor secured" position and the winch drum is fastened against rotation, thus completing retrieval procedures.

3.5.2.9

Shut off both foilborne turbines. Lower the SADDLE ASSEMBLY to engage the depressor when the ship begins coasting. (The ship should be at a speed of five knots or less.) BOOM extension downward is accomplished by moving the BOOM HEIGHT control to "DOWN" position.

Engagement of the SADDLE ASSEMBLY will be indicated by the inability of the BOOM to go further downward and by a tendency of the depressor and BOOM to shift laterally to port. When either of these conditions has been noted, immediately put BOOM LATERAL POSITION switch in "LOCK" position.

3.5.2.10

Release BOOM-LATERAL-LOCK from its unlocked position by turning TEE HANDLE, and push to assure insertion. Return BOOM LATERAL POSITION switch to "NORMAL" and simultaneously move BOOM LATERAL control as required to obtain alignment for LOCK PIN insertion.

3.5.2.11

Maintain ship speed at five knots or less using ship's diesel propulsion unit. Ship should avoid turning until retrieval is complete. (NOTE: Operation of the ship's diesel propulsion unit is not part of this manual.)

CAUTION: BOOM TOWLINE FOLLOWER must not be permitted to contact the winch drum in the following step.

3.5.2.12

Retract the depressor to a position near the "depressor secured" position so that BOOM TOWLINE FOLLOWER can be disengaged.

3.5.2.13

Disengage the BOOM TOWLINE FOLLOWER. This is accomplished by a man on the CATWALK.

3.5.2.14

Retract the depressor to "depressor secured" position and engage SAFETY LINK to keep winch drum from rotating.

NOTE: SAFETY LINK turnbuckle must be adjusted in length to prevent winch drum from backing off.

3.5.2.15

Engage BOOM-UP-LOCK manually.

3.5.2.16

Move BOOM HEIGHT control to "OFF". This action completes the depressor retrieval procedure

3.5.2.17

If depressor is to be placed in the deck cradle, proceed to Section 3.6. If depressor is to remain in the "depressor secured" position in conjunction with the "winch dead astern" position, install SWIVEL LOCK PIN and shut off electrical and hydraulic power on the console.

3.6 DEPRESSOR STOWING PROCEDURE

The following is the procedure required to move the depressor from the "depressor secured" position to the "depressor stowed" position.

3.6.1 Starting Conditions

Ship's power is on; S.H.E. hydraulic and electrical systems are on; winch is locked in the "winch dead astern" position; depressor is in "depressor secured" position; CONTROL MODE switch is in "MANUAL" position and BRAKE switch is in "NORMAL" position.

3.6.2 On-Deck Stowage of Depressor

3.6.2.1

Swivel winch over the after deck of the ship by moving the WINCH SWIVEL control slowly toward the "CW" position. When position of depressor is directly above the deck cradle, return WINCH SWIVEL control to "OFF".

3.6.2.2

Disengage SAFETY LINK restraining winch drum rotation.

> CAUTION: In the following step, keep BOOM HEIGHT control in the "DOWN" position until depressor is safely positioned in the deck cradle to prevent pitching motions.

3.6.2.3

Move the BOOM HEIGHT control to "DOWN" and reel in towline to raise depressor and BOOM by moving WINCH HOIST control to "UP". Return WINCH HOIST control to "OFF" when maximum height is accomplished. Disengage BOOM-UP-LOCK by pulling and twisting TEE HANDLE to prevent re-engagement.

3.6.2.4

Slowly pay out towline by moving the WINCH HOIST control toward the "DOWN" position. Adjust relationship between depressor and deck cradle by moving the WINCH SWIVEL control as required to achieve proper alignment.

NOTE: At the option of the operator, the winch drum BRAKE may be left engaged when lowering the depressor and BOOM to provide more accurate vertical positioning of the depressor. This is accomplished by moving the 28 VDC switch temporarily to "OFF" during pay out only. In this condition, the winch will not swivel since both the manual and automatic swivel control systems are de-energized and the swiveling actuator is hydraulically locked.

3.6.2.5

Place depressor into deck cradle. Disconnect towline electrically and mechanically from depressor, if desired, per NURDC instructions, reference 5.

3.6.2.6

Return BOOM to uppermost position by use of the BOOM HEIGHT control.

3.6.2.7

Engage BOOM-UP-LOCK by unlocking and pushing in TEE HANDLE on pedestal.

3.6.2.8

Install SWIVEL LOCK PIN to prevent WINCH from swiveling.

3.6.2.9

Verify that BOOM-LATERAL-LOCK is engaged by checking that the TEE HANDLE on pedestal is pushed in fully.

3.6.2.10

Shut off S.H.E. electrical and hydraulic systems.

3.6.2.11

Fasten depressor to deck cradle using means provided.

3.7 EMERGENCY PROCEDURES

No attempt will be made in this section to delineate a special procedure for every conceivable abnormal operating condition; experience with the S.H.E. will enable determination of the correct procedure in most cases. Certain fundamental procedures are, however, presented here covering broad catagories of malfunction to provide a baseline for safe development of operation experience. These procedures are related mainly to operation of the S.H.E. in the "AUTO" (automatic) swiveling mode since operator response to emergencies which might develop during manually-controlled operations can usually be quite deliberate without incurring risk to the S.H.E. or operating substantial personnel.

3.7.1 Hydraulic Malfunctions

Severe hydraulic malfunctions occurring during operation in the "AUTO" (automatic) swiveling mode, for example: loss of hydraulic supply pressure, burst hoses or tubing, uncontrolled swiveling, etc., by either one of two operator responses: (1) turn the 28 VDC switch to "OFF" position, or (2) turn the CONTROL MODE switch to "OFF" position. Simultaneously with either of these actions, alert the PCH-1 bridge of the existance of an emergency condition. Turning either of the above switches to "OFF" position will hydraulically lock the swiveling actuator and secure the winch in whatever azimuth position it was in when the switch was shut off. If excessive leakage or loss of hydraulic fluid was the cause for shut-down, shut off the HYD SUP (hydraulic supply) valve on the left side of the control console.

3.7.2 Loss of Towline Tension

Any condition resulting in loss of towline tension during operation in the "AUTO" (automatic) mode makes it imperative that the operator (1) turn the 28 VDC switch to "OFF" or (2) turn the CONTROL MODE switch to "OFF". This action will prevent erratic swiveling which could result from the winch swiveling in an attempt to "follow" a loose or slack towline.

Any of the following will provide the operator with a visual signal that towline tension has been lost: (1) curvature existing in the towline between the water surface and the tangent point of the towline on the winch drum; (2) towline springing out radially by any observable amount from the winch drum; (3) towline lying flat or attempting to lie down flat on the drum (as opposed to its normal nose-in-drum-groove position).

After the CONTROL MODE or 28 VDC switch has been turned off, notify the PCH-1 bridge of the emergency condition.

3.7.3 Loss of Electric Power

In the event of loss of electric power, the green PWR ON (power on) light will go out, and the S.H.E. will cease responding to swiveling commands given either manually or automatically. Alert the PCH-1 bridge of the existance of an emergency situation and shut off the 28 VDC switch. Turn CONTROL MODE switch off.

4.0 TROUBLE SHOOTING

4.1 ELECTRIC POWER

Electric power for the S.H.E. is provided by the ship's 28 VDC system. The availability of electric power should be indicated by the illumination of the green PWR ON lamp on the control console; it should be noted, however, that non-illumination could be caused by a burned-out bulb in the PWR ON lamp. In the event of a verified power failure, a check should be made of the ship's 28 VDC system to see that it is functioning normally. This done, a check of the S.H.E. power supply wiring for open or short circuits should be made from the point at which the ship's 28 VDC system is tapped for power for the S.H.E., to the CONTROL CONSOLE.

4.2 HYDRAULIC POWER

Hydraulic power for the S.H.E. is supplied by the ship's service hydraulic system. Availability of hydraulic power is indicated by the HYD PRESS (hydraulic pressure) gage on the control console. Should this gage indicate a lack of hydraulic pressure, a check should be made of (1) the HYD SUP (hydraulic supply) valve on the side of the console to assure that it is in "OPEN" position, (2) the ship's service hydraulic system to assure that it is functioning normally, and (3) the shut-off valve on the pressure gage. If a drop in supply pressure is indicated by the HYD PRESS gage during S.H.E. operation, check the HYD SUP valve to assure that it is fully open. Check also the supply and return lines to assure that these are free of blockage and that there are no partially closed valves which are throttling flow.

4.3 WINCH SWIVELLING SYSTEM

The following checks should be made in the event of failure of the winch to swivel.

4.3.1 Check swivel lock pin to assure that it has been removed.

4.3.2 Check for availability of electrical power per paragraph 4.1.

4.3.3 Check for availability of hydraulic power per paragraph 4.2.

4.3.4 With CONTROL MODE switch on "MANUAL", check actuator bypass for an audible indication of hydraulic pressure at the actuator when the WINCH SWIVEL control lever is moved.

4.3.5 Check for electric current at the swivelling servo valve electrical leads with a milliameter. The cause of a lack of current at this point can be determined by a systematic checkout of the electrical components of the S.H.E. swivelling system shown on drawing 25-56067.

> WARNING: In the following check, proper safety precautions, such as restraining lines, etc., should be used during this check since the winch will normally swivel very easily and therefore respond to ship pitch and roll, wind, etc.

4.3.6 With hydraulic power shut off, swivel the winch by hand to assure that it swivels freely.

4.3.7 Check for a sheared actuator key by (1) observing the electrical response of the winch azimuth sensors (normal response of these sensors to swivelling commands would indicate a sheared key) or (2) attempting to gently swivel the winch by hand slightly beyond the normal swivelling limits imposed by the actuator (approximately 70° to starboard or 175° to port).

4.3.8 If the winch swivels with the CONTROL MODE switch in "MANUAL", but not in "AUTO" or "AUTO CK", perform a systematic checkout of the electrical components of the winch swivelling system shown on 25-56067.

4.4 OTHER COMPONENTS AND SYSTEMS

Trouble shooting of other components and systems of the S.H.E. should be accomplished using the following general pattern:

4.4.1 Check to insure that all lock pins, safety links, and other mechanical locks and stops have been disengaged from the part affected.

4.4.2 Check for the availability of electric and hydraulic power per paragraphs 4.1 and 4.2.

4.4.3 With all electric and hydraulic power shut off, check for mechanical freedom of the ma_functioning part.

4.4.4 Check hydraulic orifices and valves for blockage, control handles for looseness, etc.

5.0 MAINTENANCE

5.1 INTRODUCTION

The following procedures are recommended to maintain the operating efficiency of the Specialized Handling Equipment and provide it with protection against a marine environment. While resistance to sea and weather influences was a primary consideration in the selection of materials in the design of the equipment, certain portions of the equipment have utilized materials that will require periodic maintenance. By following the procedures identified in this section, the full benefits of the design can be achieved.

5.2 SWIVELLING MACHINERY

5.2.1 Swivelling Actuator

The swivelling actuator (Model No. 150,000, shown on drawing 25-56052) should require no servicing.

Visual inspection for hydraulic fluid leakage should be performed daily during periods of equipment operation. If more than a slight weeping of hydraulic fluid is in evidence, seal replacements may be necessary. Seal replacement can be accomplished in the field following the manufacturer's technical manual, reference 4.

5.2.2 Bearings and Seals

The swivel bearings (NU330 and 94114D/NA94700) and seal (53X3592) shown on drawing 25-56052 are packed with grease on assembly. They should not require further attention. However, should these bearings be made accessible due to winch disassembly, for example, or if the winch is to be put into operation after six or more months of inactivity, the bearings and seals are to be visually inspected, cleaned and repacked with MIL-G-23827 grease. Seals should be replaced if damage during disassembly operations, or if wear is observed.

5.3 DRUM DRIVING MACHINERY

5.3.1 Hydraulic Motor

The drum-driving hydraulic motor (MIF05-014-33N-004-S4 on drawing 25-56052) requires no periodic maintenance. Visual inspection of the hydraulic motor should be made after each day's operation for evidence of hydraulic fluid leakage. If seal replacement is judged necessary, or if the motor fails to operate for any reason, it is recommended that the motor be returned to the manufacturer for repair or that it be replaced.

5.3.2 Reductor

The reductor (247 DPH-24 shown on drawing 25-56052) should be drained of originally supplied oil and flushed with light oil after 80 hours of drum driving operation. Refill with three quarts of Mobil D.T.E. Oil (heavy medium), or equivalent. Thereafter, drain and refill with the above oil after each 250 hours of operation. Additional information is provided in reference 3.

5.3.3 Roller Chain

The drum-driving chain (25-56052-14) must be kept lightly coated with MIL-G-2382, grease. This grease is to be applied with a stiff brush at the end of each five operating days and at any sign of corrosion. The chain should be visually inspected for corrosion daily when the equipment is being used and at least once a week if not in use.

> NOTE: When applying grease to the chain, do not allow grease to get onto brake disk. Brake disk may be degreased by wiping it clean with methyl ethyl ketone (MEK) or other suitable degreasing solvent and a clean wiping cloth.

5.3.4 Drum Support Pillow Blocks

The drum support pillow blocks (FSAF 22520A, drawing 25-56052) are to be greased with a grease gun after each five days of winch operation.

Use grade 2 Lithium-base grease. Excess grease exuding from the pillow blocks is to be removed. When the equipment is not in use, greasing should be accomplished at least at monthly intervals.

5.3.5 Drum-Control Brake and Brake Disk

The disk brake (419-61, drawing 25-56052) which helps control drum rotation requires no special service. Caliper adjustment and seal or brake pad replacements are to be accomplished per the caliper manufacturer's manual, reference 6. This may be done in the field.

NOTE: Do not paint the adjusting screws or the caliper brake pads. These surfaces must be left bare.

CAUTION: Examine the entire surface of both sides of the brake disk at the start of each day's operation to ensure that they are absolutely free of grease or other contaminants that would cause slipping to occur. Examine the caliper brake pads and adjacent areas to assure that they are absolutely free of grease or other contaminants that would cause slipping to occur.

NOTE: Grease may be removed with methyl ethyl ketone (MEK) or other suitable degreasing solvent, and clean wiping cloths.

5.4 BOOM AND CARRIAGE MACHINERY

5.4.1 Hydraulic Cylinders

The boom-control hydraulic cylinders on drawings 25-56052 and 25-56063-22 require no special servicing. Should seal replacement become necessary as evidenced by hydraulic fluid leakage, such service can be carried out in the field in accord with the manufacturer's technical manual, reference 7.

Bearings and bushings should be coated with MIL-G-23827 grease every five operating days. Cylinder rods should be similarly coated whenever

the equipment is not to be used or has not been used for two days or more. Rods so coated should be cleaned with MEK solvent before reuse of the equipment.

5.4.2 Boom Carriage Locks

Load-bearing and sliding surfaces of the boom lock mechanisms (25-56063-74, and -75, and exposed sliding portions of -76, and -19) are to be kept coated at all times with MIL-G-23827 grease. They should be checked daily when the equipment is in operation. When the equipment is not in use, greasing should be accomplished at least at monthly intervals.

5.4.3 Boom Vertical Drive Motor

Maintenance to the boom vertical drive motor (25-56063-68) is the same as that described in Section 5.3.1 for the drum-driving hydraulic motor.

5.4.4 Boom Vertical Drive Train

Maintenance to the boom vertical drive train (25-56063-71) is the same as that described in Section 5.3.3 for the drum-driving train.

5.4.5 Boom Vertical Drive Bushings

Bushings in the boom vertical drive train (25-56063-72) are to be lubricated before each day's operation with any good quality light engine oil.

5.4.6 Boom Vertical Drive Rack and Pinion

The boom vertical drive rack and pinion (25-56063-82 and 25-56063-5) are to be kept coated at all times with MIL-G-23827 grease to prevent corrosion. An inspection for corrosion should be made daily during periods of equipment operation, and at least once a week otherwise. (Note: Since these components are made of steel and will become wet with sea water during normal operation, particular care must be given in the visual inspection process for evidence of corrosion. Both the rack and pinion may be easily replaced in the field, if necessary.)

5.4.7 Boom

Leading and trailing edges of the boom assembly are to be coated with MIL-G-23827 grease after each five operating days. Steel inserts on the upper portion of the boom leading and trailing edges should be inspected daily for signs of corrosion.

5.4.8 Carriage Rollers

Bushings in the carriage rollers (25-56063-9 & -10) are to be lubricated before each day's operation with any good quality light engine oil.

5.5 TOWLINE ANGLE MEASUREMENT MACHINERY

5.5.1 Electrical Connectors

Electrical connectors at the sensor assemblies (25-56061-2 and 25-56061-7) are to be inspected on each operating day for evidence of corrosion, and at least weekly during periods of inactivity. These connectors are to be protected with Dow-Corning Silic grease or equivalent protective compound.

5.5.2 Traversing Rods

The measurement machinery traversing rods do not require lubrication. They should always be kept clean, i.e., free of dirt, grime, salt, and grease.

> NOTE: Do not paint traversing rods except in the area of the attaching nuts.

5.5.3 Bearings and Seals

Bearings and seals in Assembly 25-56061-2 are packed in grease on assembly. No special maintenance is required. If, however, these components become accessible due to equipment disassembly, the bearings and seals are to be visually inspected, cleaned and repacked with MIL-G-23827 grease.

5.6 WINCH DRUM AND TOWLINE

CAUTION: Failure to place grease to the bottom of the vacant grooves as noted below may cause the rubber towline cover to wear, damaging hydrodynamic contour and endangering the structural integrity of the faired towline.

5.6.1 Winch Drum

Towline receiving grooves in the winch drum (25-56061-18) are to be liberally coated with MIL-L-4343 grease before any towline is wound on for the first time. Thereafter, during towing operations when the towline is payed out and the winch CONTROL MODE switch is in "MANUAL" position, additional grease is to be applied to vacated drum grooves.

If over a period of time the grease covering the surface of the winch drum grooves becomes contaminated with dirt or other gritty substances, the contaminated grease is to be removed from the storage drum and towline. Remove the bulk of the contaminated grease taking care not to mar the winch drum surface or the towline surface. Final traces of grease can be removed using MEK or other suitable degreasing solvent and clean wiping cloths.

To minimize the contamination rate of the drum surface grease a suitable cover, such as a plastic sheet, can be utilized to cover the towline at the end of each day's operations. It is recommended that this action be taken whenever the S.H.E. is not to be operated for one week or more.

5.6.2 Towline

Under ordinary operating conditions, the only servicing of the towline is to assure that the towline-winch drum interface is always greased as noted in Section 5.6.1 above. End fittings, however, are subject to fatigue and are to be replaced periodically in accord with Reference 8.

NOTE: While the towline is capable of taking very high tension loads while it is wrapped around the winch drum, the towline is not capable of being twisted or bent sharply over short lengths without being irreparably damaged. While no operating conditions are anticipated that will impose large twisting motions or sharp bends to the towline, extreme care should be exercised whenever a towline is installed on or removed from the winch drum.

NOTE: The Hypalon rubber covering of the towline is not resistant to the Skydrol hydraulic fluid used in PCH-1 and the S.H.E. Prolonged exposure of the towline to Skydrol will cause the cover to swell and become much less resistant to abrasion. It is important, therefore, that any Skydrol which comes into contact with the towline be removed as soon as possible. This may be accomplished by (1) a copiously-applied water flush followed by (2) a solvent rinse using methyl ethyl ketone or other commercial degreasing solvent and (3) another water rinse.

Discussion of towline end fittings, towline structural capacity, fatigue considerations and recommendations for towline servicing is not part of this manual. However, extensive information concerning this vital topic is specifically provided in reference 8.

5.7 CONTROL CONSOLE

The control console (25-56070-1) does not require periodic maintenance. It is recommended that the console be protected when not in use by a suitable rain-tight cover. Additional protection against moisture can be afforded to electrical components by coating them with Dow Corning Silicon grease or equivalent protective compound at those times when the interior of the console is accessible for any reason.

5.8 HYDRAULIC HOSES AND ELECTRICAL WIRING

Hydraulic hoses and external electrical wiring require no service. Points of potential wear or chafing, however, should be inspected for wear after each operating day. Areas indicating the inception of wear or chafing can be protected by tape, minor rerouting, etc. If any hoses or wiring show substantial wear, they are to be replaced.

5.9 PAINTING

In general, all parts not covered with grease, or specially excluded from protective coatings by notes in this manual, are to be kept coated with paint. Chips in the original paint should be repaired with Gray No. 27 paint per Formula 5H, MIL-E-15130. Larger exposed areas should be sanded and painted with two coats of zinc chromate primer per Formula 84/47, TT-P-645, followed by two coats of Gray No. 27 paint.

5.10 FAYING SURFACES

If for any reason faying surfaces are parted during the life of the equipment, refer to the appropriate drawings to determine what surface treatment is required as a prerequisite for reassembly.

5.11 GENERAL

Visually inspect all exposed areas of the S.H.E. before each day's operation and determine that the general condition of the equipment is satisfactory. Look for leaks, frayed hoses, loose nuts and/or bolts, wear on the towline, etc., and take corrective action as necessary.

Insofar as is possible, the S.H.E. should be kept free of dirt, grime, salt, etc. This is especially important on grease-covered parts. These tend to retain contaminants which may cause rapid wear of sliding surfaces. Should substantial amounts of sea water come into contact with the S.H.E., it is desirable to provide a fresh water washdown as soon as practicable.

6.0 PARTS LIST

A complete listing of all parts of the Specialized Handling Equipment is given in Sheet 1 of each of the drawings listed below. These drawings are contained in Volume 2 of this document.

25-56051	Winch Installation
25-56052	Winch Assembly
25-56053	Drum Assembly
25-56054	Winch Pedestal
25-56055	Winch Support Beam Assembly
25-56056	Winch Foundation, Ship Modification
25-56057	Drum Shaft and Miscellaneous Fittings
25-56058	Winch Catwalk Assembly
25-56059	Drum Driving Machinery
25-56060	Swivelling Machinery
25-56061	Towline Angle Measurement Machinery
25-56062	Boom Assembly
25-56063	Boom Carriage Assembly
25-56064	Restraining Saddle
25-56065	Hydraulic System
25-56066	Electrical Cable Drum Assembly & Installation
25-56067	Electrical System
25-56070	Control Console
25-56071	Exhaust Deflector Details
SK11-042634	Safety Link
SK11-042639	Azimuth Measurement Calibration Fixtures

REFERENCES

Reference No.	Title
1	D2-133060-1: Final Report: Design, Fabrication and Test of a Specialized Handling Equipment
2	Towed Body Technical Manual - (NURDC)
3	Boston Gear Optimount Reductor Instructions
4	FLO-TORK Maintenance Instructions, FS 103R, FlO-TORK Div, Allen Electric and Equip., Orrville, Ohio
5	D602-F-SK059 Depressor Installation (NURDC)
6	Manual 1868: Installation and Mainterance of the B. F. Goodrich 419-61 Brake Head Assembly
7	Catalog 1110, Hannifin Cylinder Division, Parker-Hannifin Corp. (See also Bulletin 1110-M1, same source)
8	D2-133043-1: Procurement and Tests Concerning Long Lengths of Continuous Faired Towlines (Final Report)

LIMITATIONS

This document is controlled by Marine Branch

All revisions to this document shall be approved by the above noted organization prior to release.

THE BOEING COMPANY

NUMBER D2-133056-1
REV LTR

ACTIVE SHEET RECORD

SHEET NUMBER	REV LTR	ADDED SHEETS				SHEET NUMBER	REV LTR	ADDED SHEETS			
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REVISIONS			
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